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Sandia National Laboratories

April 30, 2003

The Honorable Spencer Abraham
Secretary
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585

Dear Secretary Abraham:

We are writing to congratulate you and encourage you in your continuing efforts to reestablish United States leadership in nuclear energy. Initiating the Advanced Fuel Cycle Initiative and advancing the Generation IV program are clear indications of the bold leadership that is being demonstrated by this Administration.

In July 2002, you will recall that we wrote to you to urge that the Department of Energy (DOE) implement a comprehensive and integrated plan to further the development of nuclear energy and the management of nuclear materials. Such a plan can help achieve a vision of sustainable peace, prosperity, and environmental quality, enabled through immediate United States leadership in the global expansion of nuclear energy systems. The actions you have taken thus far are in keeping with the key recommendations from our letter, which were for DOE to:

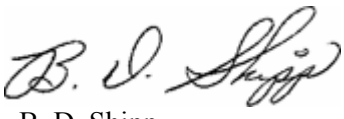
- Assist the deployment by United States industry of new power plants by 2020;
- Reduce actinide waste and plutonium stockpiles by closing the fuel cycle;
- Restore the industrial and R&D infrastructures;
- Provide technologies and strengthen the regime for safeguards integrated within existing and advanced fuel cycles; and
- Provide sustainable energy sources that mitigate global climate change and water availability issues.

Bill Magwood met with our group and challenged us to build on the recommendations of our July 2002 letter. We have responded by preparing an Action Plan that sets three very challenging goals to accelerate and enhance DOE's nuclear energy programs. A key focus of our effort is an analysis of the ways in which nuclear energy can be used to produce hydrogen. Our approach is consistent with the Administration's vision of an emissions-free transportation system while simultaneously and aggressively addressing nuclear materials management concerns.

We applaud you for the steps you have taken to advance the nuclear energy option in the United States. We encourage you to act expeditiously on the recommendations contained in our Action Plan. We are ready to assist you in realizing our collective vision of nuclear energy as a key component of a safe, secure, and sustainable energy system.

Sincerely,

Hermann A. Grunder
Argonne National Laboratory



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Nuclear Energy: Power for the 21st Century
An Action Plan

Energy is vital to human civilization. It underpins national security, economic prosperity, and global stability. As the world's most powerful and prosperous nation, the U.S. must lead the way in developing a diverse energy system that can meet rapidly growing world energy demand in a way that promotes peace, prosperity, and environmental quality. This diverse energy system must include a growing component of nuclear energy.

In July 2002, the Directors of six Department of Energy (DOE) national laboratories wrote to the Secretary of Energy to urge DOE to "*implement a comprehensive and integrated plan to further the development of nuclear energy and the management of nuclear materials*." Such a plan can help achieve the Laboratory Directors' vision:

Vision:
Sustainable peace, prosperity, and environmental quality, enabled through immediate U.S. leadership in the global expansion of nuclear energy systems.

DOE has taken aggressive and commendable steps to ensure that nuclear energy plays a large role in our energy future. After the July 2002 letter, DOE asked the Laboratory Directors to provide specific recommendations regarding what strategic directions should be followed to enable an expanded use of nuclear energy. The letter had called for the Secretary to "*accelerate and enhance Departmental nuclear energy, reactor waste and nuclear materials management programs:*

- *To assist the deployment by U.S. industry of multiple new power plants by 2020;*
- *To reduce actinide waste and plutonium stockpiles by closing the fuel cycle;*
- *To restore the industrial and R&D infrastructures;*
- *To provide technologies and strengthen the regime for safeguards integrated within existing and advanced fuel cycles; and*
- *To provide sustainable energy sources that mitigate global climate change and water availability issues."*

This Action Plan responds to DOE's request. The Plan builds on the recommendations of the July 2002 letter by setting three challenging goals with associated objectives and enabling actions. Following the goals are specific proposals for accelerating and enhancing DOE's nuclear energy programs in the near-term to place the U.S. on a path to achieve the goals.

Goal #1: Reduce air pollution and global climate risk and improve energy security by meeting an increasing fraction of future US and world energy needs through safe and economic nuclear energy solutions

Objective: 50% of U.S. electricity produced by nuclear power and 25% of U.S. transportation fuels supplied by nuclear-generated hydrogen by 2050
Enabling Actions:

- As envisioned by the Administration's National Hydrogen Energy Roadmap, undertake R&D to develop a hydrogen fuel system including production, storage, distribution and use
- Commit in 2004 to build a gas-cooled reactor to demonstrate nuclear-hydrogen and electricity production, and complete construction by 2010-2012
- Demonstrate advanced nuclear-hydrogen production process technology (in a non-nuclear facility) by 2006, to support the gas-cooled reactor project
- Enable industry to place an order for at least one new nuclear power plant by 2008

- Build a next-generation, fast-spectrum liquid metal-cooled nuclear power plant in the U.S. by 2020, for the purpose of electricity production and nuclear materials management

Estimated Cost: $5B

Objective: Cooperatively develop internationally deployable systems to enable 10 to 15% of world energy to be produced by nuclear means by 2050 (with systems that are proliferation-resistant, economic, safe, sustainable, and physically protected)

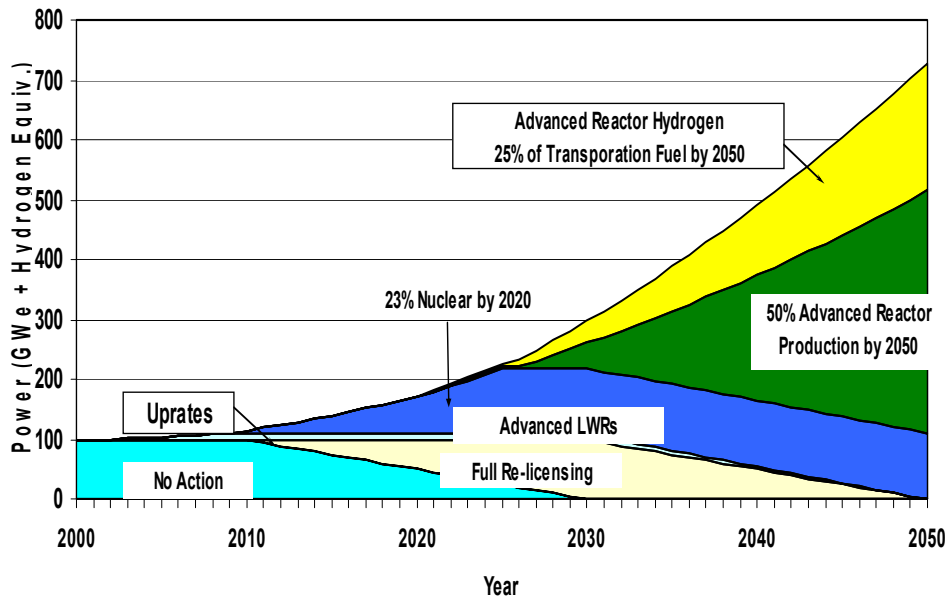
Enabling Actions:

- Develop international cooperative programs by 2005 to allow increased international deployment of nuclear systems
- Strive to implement a U.S.-Russian agreement for cooperative research consistent with the commitment from the Bush-Putin summit.
- Work with international partners to jointly build a next-generation nuclear power plant abroad by 2025

Estimated Cost: $0.5B for initial technology development support

Achieving this goal will have the benefits of:

- Reducing U.S. carbon dioxide emissions by 3 billion metric tons per year and world carbon dioxide emissions by up to 6 billion metric tons per year by 2050 (current U.S. carbon dioxide emissions from energy consumption are about 6 billion metric tons per year),
- Enhancing energy security by replacing oil with nuclear-generated hydrogen for transportation use. This will reduce U.S. oil consumption by 2 billion barrels per year and world consumption by up to 3 billion barrels per year by 2050 (current U.S. oil consumption for transportation is about 4.6 billion barrels per year), and will help stimulate U.S. demand for fuel cell vehicles,
- Rejuvenating the U.S. nuclear infrastructure, and
- Advancing U.S. leadership in nuclear technology and providing significant commercial opportunities for U.S. industry



Benefits:

- Reduce U.S. CO2 emissions by 3 billion metric tons per year
- Reduce U.S. oil consumption by 2 billion barrels per year
- Achieve a 90% reduction in reactor waste requiring repository disposal
- Enabling the technology for nuclear energy to be an energy resource for centuries
- Consume 50% of the inventory of plutonium in U.S. used fuel

To realize a strong nuclear contribution to global energy security – in both electrical generation and the production of hydrogen for transportation with attendant nuclear materials management – strategic R&D investments are needed now

Goal #2: Achieve a 90% reduction of reactor waste requiring repository disposal by 2050 by significantly reducing the amount of uranium, plutonium, and minor actinides in disposed waste

Objective: Demonstrate a closed fuel cycle technology system by 2020
Enabling Actions:

- Build a pilot facility to demonstrate advanced technology for partitioning waste and recycle by 2010
- Build a pilot fuel supply and testing facility by 2010
- Demonstrate actinide burning in an advanced system by 2020

Estimated Cost: $2B

Achieving this goal will have the benefits of:

- Eliminating the technical need for a second repository in this century,
- Compared with the once-through fuel cycle, achieving a 50% reduction of plutonium inventories in U.S. used fuel, and
- Enabling the technology to sustain the nuclear energy supply for centuries

Goal #3: While expanding the use of nuclear technology world wide, reduce the threat of nuclear weapons proliferation

Objective: By 2020, demonstrate a global nuclear energy technology system consisting of intrinsic and extrinsic safeguards that minimizes proliferation risk
Enabling Actions:

- Develop and sustain an analytical framework and standards for quantifying integrated proliferation risk by 2005
- Accelerated development of affordable technologies and multilateral transparency systems from cradle to grave with an integrated demonstration by 2008
- Recommend an international framework for implementing sustainable global management of nuclear materials and services by 2008

Estimated Cost: $1B

Achieving this goal will have the benefits of:

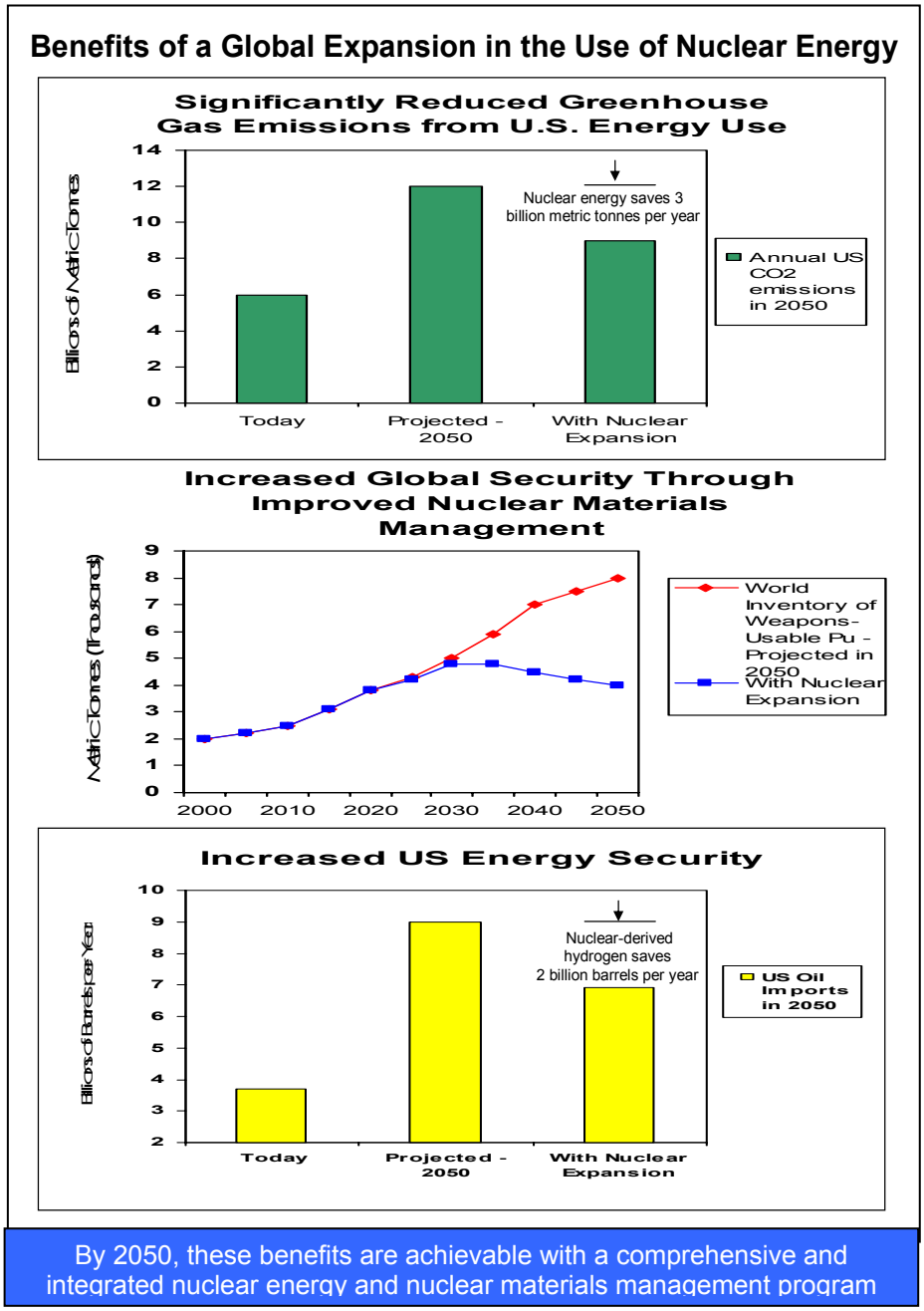
- Establishing U.S. approaches and technology as world standards for proliferation resistance by 2015, and
- Enabling the elimination of 50% of the world stock of weapons-capable plutonium by 2035

These challenging goals require that the U.S. significantly increase its investment in nuclear energy technology development. U.S. leadership in this area is critical to meeting growing world energy needs while increasing security and protecting the environment. Ongoing U.S. nuclear energy R&D programs must be accelerated and government investment increased substantially if the U.S. is to be on a path to meet the goals.

The Laboratory Directors recommend four specific actions to be taken in the near-term:

1. **Provide significant incentives for-near-term deployment of new nuclear power plants in the U.S. -** If new nuclear power plants are to be built in the U.S., the financial risk of new construction must be reduced. An in-depth analysis by Scully Capital Services concluded that once the first several plants have been built and operated, new nuclear power plants can be fully competitive in the marketplace. Through the Nuclear Power 2010 program, DOE is working with industry to reduce regulatory and other uncertainties. Sustained investment in this program is warranted, as are additional measures by the Administration and Congress to help industry manage the financial risk of the first several new nuclear plants.

2. **Develop and demonstrate advanced Generation IV reactor systems that can support a major expansion of nuclear energy – for both electricity production and generation of hydrogen for transportation – in the first half of the 21st century** – A substantial increase in investment in research and development is required to support a decision in 2004 to construct a nuclear high-temperature reactor hydrogen production demonstration; a timely demonstration of hydrogen production technology (using a non-nuclear heat source) by 2006; and construction of a demonstration reactor by 2010 to 2012. The schedule for development of liquid metal-cooled fast reactor technology should be accelerated and the investment should be increased to enable down-selection to a single fast reactor system by 2010, leading to demonstration by 2020. When possible, expand international cooperation to include Russia which has significant experience with several of the reactor concepts under consideration in Generation IV. DOE should also consider increasing its investment in research leading to the deployment of nuclear energy technologies for other process heat applications, including the production of clean water to respond to this growing world problem.

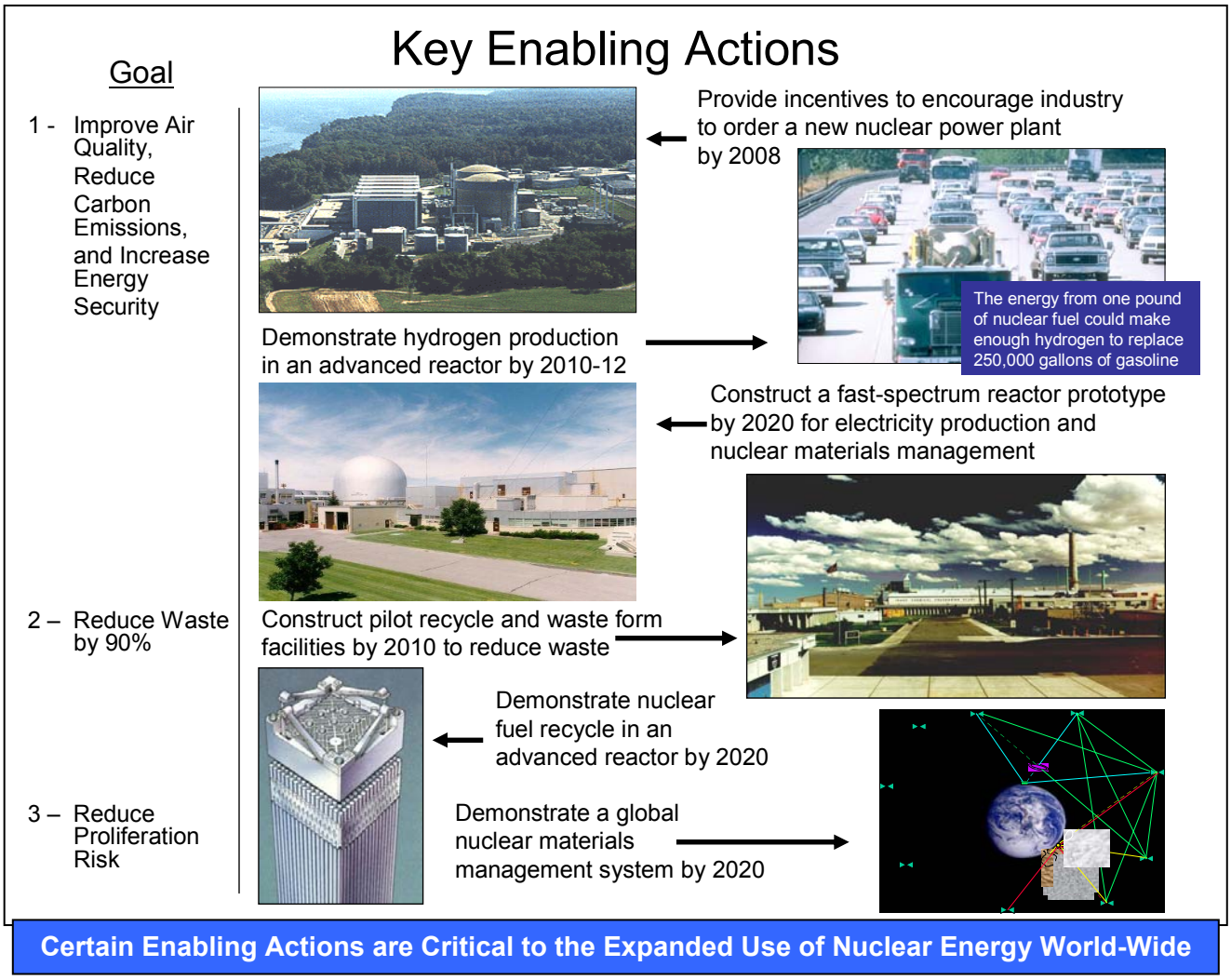


3. **Develop and demonstrate closed fuel cycle technology to produce an economically, socially, and politically sustainable fuel cycle of the future** – The Advanced Fuel Cycle Initiative must be accelerated to put the U.S. in a position to make informed, timely decisions regarding the future nuclear fuel cycle. A closed fuel cycle will be required to enable a large-scale, sustainable expansion of nuclear energy. A multi-technology approach is required, culminating in the construction of a flexible pilot recycle and waste form plant by 2010 that demonstrates commercial viability.

4. **Demonstrate technology that will set the world standard for proliferation prevention** – New technologies are needed in the areas of the global management of nuclear materials; development of fuels, reactor materials and integrated systems that enable reduced refueling requirements and reduced attractiveness of fuel cycle materials; advanced monitoring and control systems for improved plant operations; and enhanced safeguards to provide high levels of external observability, plant protection, and information management. As a first step, metrics must be established for proliferation risk and technical approaches must be developed to achieve proliferation risk reduction. Simultaneously, initiate a program to develop advanced fuels, materials, and sensors, to reduce the availability of desirable materials that pose a diversion risk.

In the process of realizing the above goals, DOE will build new research, development, and demonstration facilities and attract new scientists and engineers to the nuclear field. This will have the natural and desirable effect of restoring the U.S. nuclear infrastructure, which has been weakened by the interruption and termination of most U.S. nuclear energy programs. Specifically, DOE will find that in achieving the goals, it will make sustained and substantial investments in the nuclear R&D infrastructure on four fronts:

- *University nuclear education*: Implement the recommendations of the Nuclear Energy Research Advisory Committee and significantly increase support for university programs.
- *National laboratory resources*: Rebuild expertise within key DOE national laboratories that have and will continue to constitute the government's core competency for nuclear technology.



- *Base Nuclear Technologies*: Support a base technology program to underpin the research programs discussed in this plan. This program will have the added benefit of encouraging more researchers to enter the nuclear field.
- *Information Preservation*: Support a concerted effort to ensure that technology developed in the past is preserved and leveraged in ongoing programs.

These steps will provide the technological base and infrastructure that will form the underpinnings necessary for the U.S. to have a future commercial nuclear enterprise.

The July 2002 letter to the Secretary called for an additional $1 billion above planned nuclear energy R&D and infrastructure investment over the next five years. This recommendation recognized that, in order to realize a strong nuclear contribution to global energy security – in both electrical generation and the production of hydrogen for transportation – strategic R&D investments are needed now. The nuclear energy R&D program recommended herein will require a large investment in research and infrastructure, but will be well worth the investment. History is an excellent guide in this regard; the total U.S. government investment in commercial nuclear fission research and development over the past 50 years is roughly equal to the revenue from nuclear-generated electricity in the U.S. each year. To implement the recommendations in the Action Plan will require DOE's investment in nuclear energy R&D and infrastructure be increased from the present level, as follows:

	FY 2003 Approp.	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
DOE Nuclear Energy R&D and Infrastructure Investment	$152M	$250M	$300M	$350M	$425M	$500M

To accomplish the long-term goals outlined in this Action Plan will require a sustained government commitment totaling less than $10 billion. The benefits of this investment to U.S. energy security, environmental quality, and national security are substantial. The opportunity that this activity represents to provide for sustainable world peace, free from the threat of global conflicts over energy supplies and the proliferation of nuclear weapons, prosperity for the world's peoples deriving from abundant and affordable energy supplies, and protecting the global environment with clean, emissions-free nuclear energy, constitutes a legacy of leadership fully befitting the United States of America. The Directors of the Department of Energy National Laboratories remain fully committed to supporting the accomplishment of these goals.